Update on Occupational Dermatology

2008 NASA Occupational Medicine Conference
Baltimore, MD
July 7, 2008

Boris D. Lushniak, MD, MPH
Assistant Commissioner, Counterterrorism Policy
Office of Counterterrorism Policy and Planning
Office of the Commissioner, FDA

OCET
Office of Counterterrorism
& Emerging Threats

DISCLOSURE OF CONFLICTS OF INTEREST

Boris D. Lushniak, MD, MPH

- I do not have any relevant financial relationships with any commercial interests
- No off-label discussion of drugs or devices
- Work supported by US Government (DHHS, PHS, FDA, CDC/NIOSH)

Purpose

- To describe the public health impact of occupational skin diseases (OSDs)
- To introduce you to the spectrum of OSDs

Occupational Skin Diseases

- NIOSH and OSHA role
- Epidemiology / Public health importance
- General causes
- Clinical spectrum
- Diagnosis
- Prevention

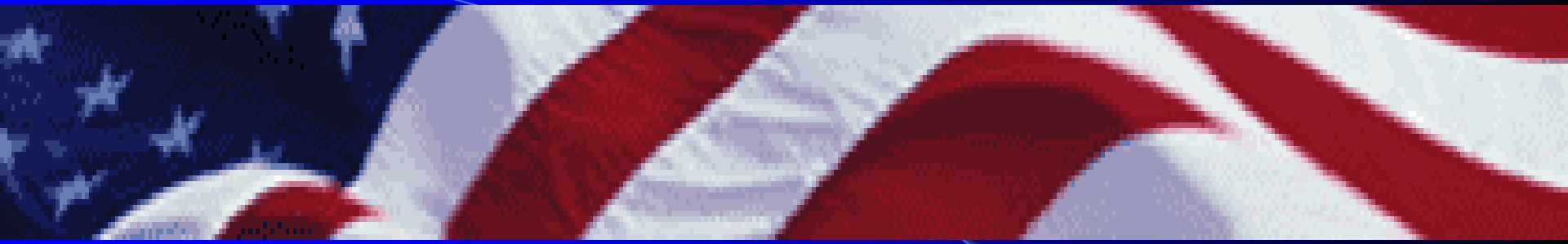
Occupational Medicine

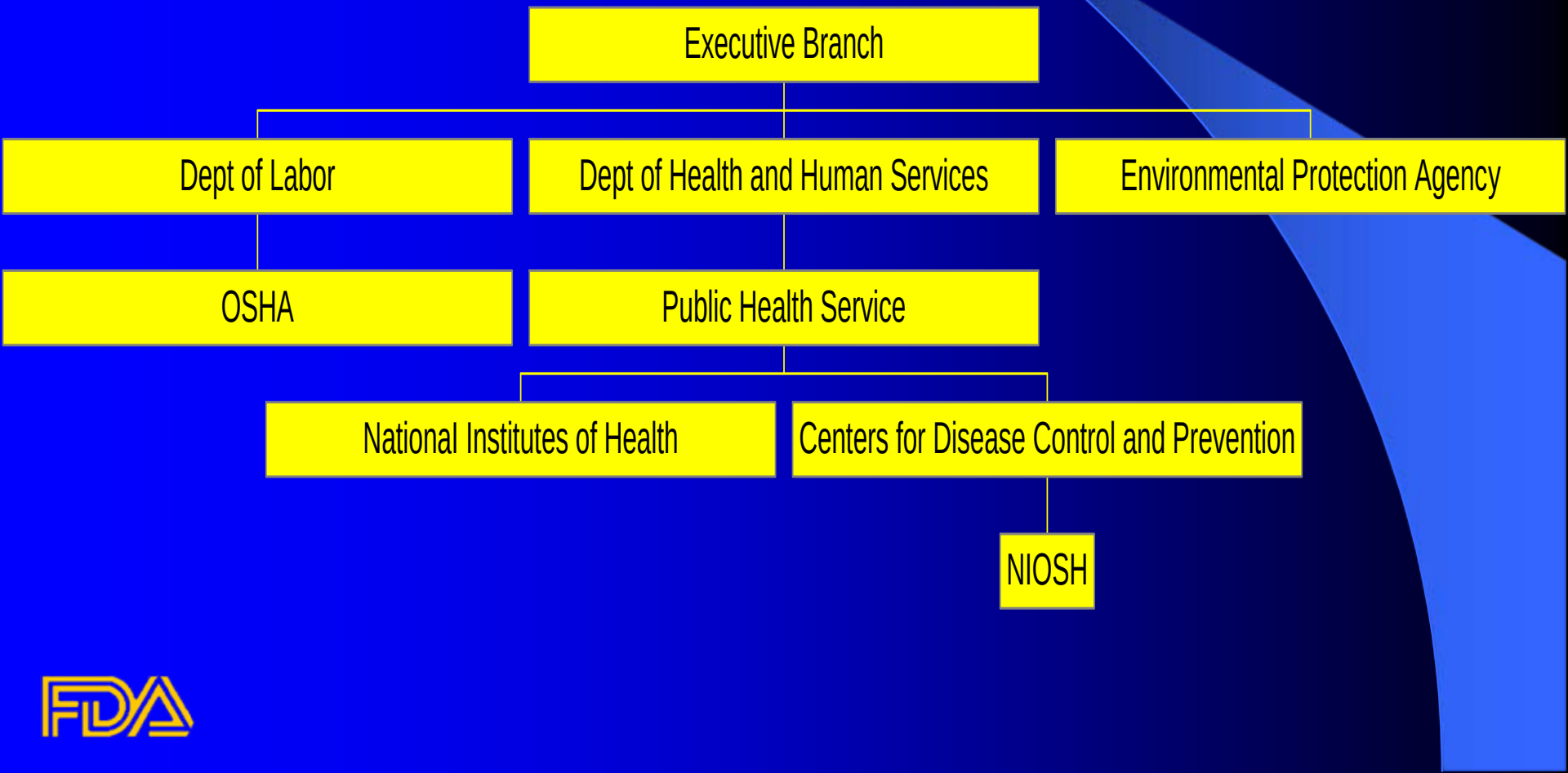
- to suggest medical precautions for the prevention and treatment of such diseases as usually affect workers…a doctor…should…question…carefully… What occupation does he follow?

  – Bernardino Ramazzini, De Morbis Artificum 1713

Occupational Dermatology

- Variety of skin diseases
- Related directly or indirectly to the workplace
- The goal is an etiologic diagnosis
- The key is prevention




Executive Branch
Dept of Labor
Dept of Health and Human Services
Environmental Protection Agency
OSHA
Public Health Service
National Institutes of Health
Centers for Disease Control and Prevention
NIOSH

National Institute for Occupational Safety and Health (NIOSH)

- Established by the Occupational Safety and Health Act of 1970 (Public Law 91-596)
- This same act created the Occupational Safety and Health Administration (OSHA)
- NIOSH became part of the Centers for Disease Control and Prevention (CDC) in 1973

Responsibilities

- Investigate potentially hazardous working conditions
- Evaluate hazards in the workplace
- Create and disseminate methods for preventing disease, injury and disability
- Conduct research and provide recommendations for protecting workers
- Provide education and training

FDA

National Institute for Occupational Safety and Health

NIOSH

Activities

- Field studies
- Surveillance
- Laboratory research
- Methods development
- Respirator certification
- Training
- Publications

FDA

The NIOSH Health Hazard Evaluation (HHE) Program

- Responds to requests for assistance
- Provides current health hazard data to employees and employers
- Identifies problems and recommends workplace solutions
- Precipitates research
- Generates human exposure and toxicity data

United States OSHA Occupational Safety & Health Administration U.S. Department of Labor

Responsibilities

- Establish workplace safety and health regulations / standards
- Enforce workplace safety and health regulations / standards
- Investigate suspected violations
- Reach out to employees / employers thru technical assistance and consultant program

FDA

Epidemiology and Public Health Importance

OCET
Office of Counterterrorism
& Emerging Threats

Public Health Impact of Disease

- How many and who are affected?
  - Absolute numbers, prevalence, incidence
- What happens to those affected?
  - Prognosis, burden of disease (job changes)
- How much does it cost?
  - Economic data, psychosocial data
- Is it preventable?
  - Prevention and intervention studies

Public Health Service Healthy People 2010

Reduce occupational skin diseases and disorders to an incidence of no more than 46 per 100,000 full time workers

Bureau of Labor Statistics Annual Survey

- National annual survey of about 182,400 employers (2005) conducted by US Dept of Labor, Bureau of Labor Statistics (BLS) and State agencies
- Participant employers are selected to be a representative sample of all private industries
- Based upon forms [OSHA-300 logs] which are completed by employers for occupational injuries/illnesses

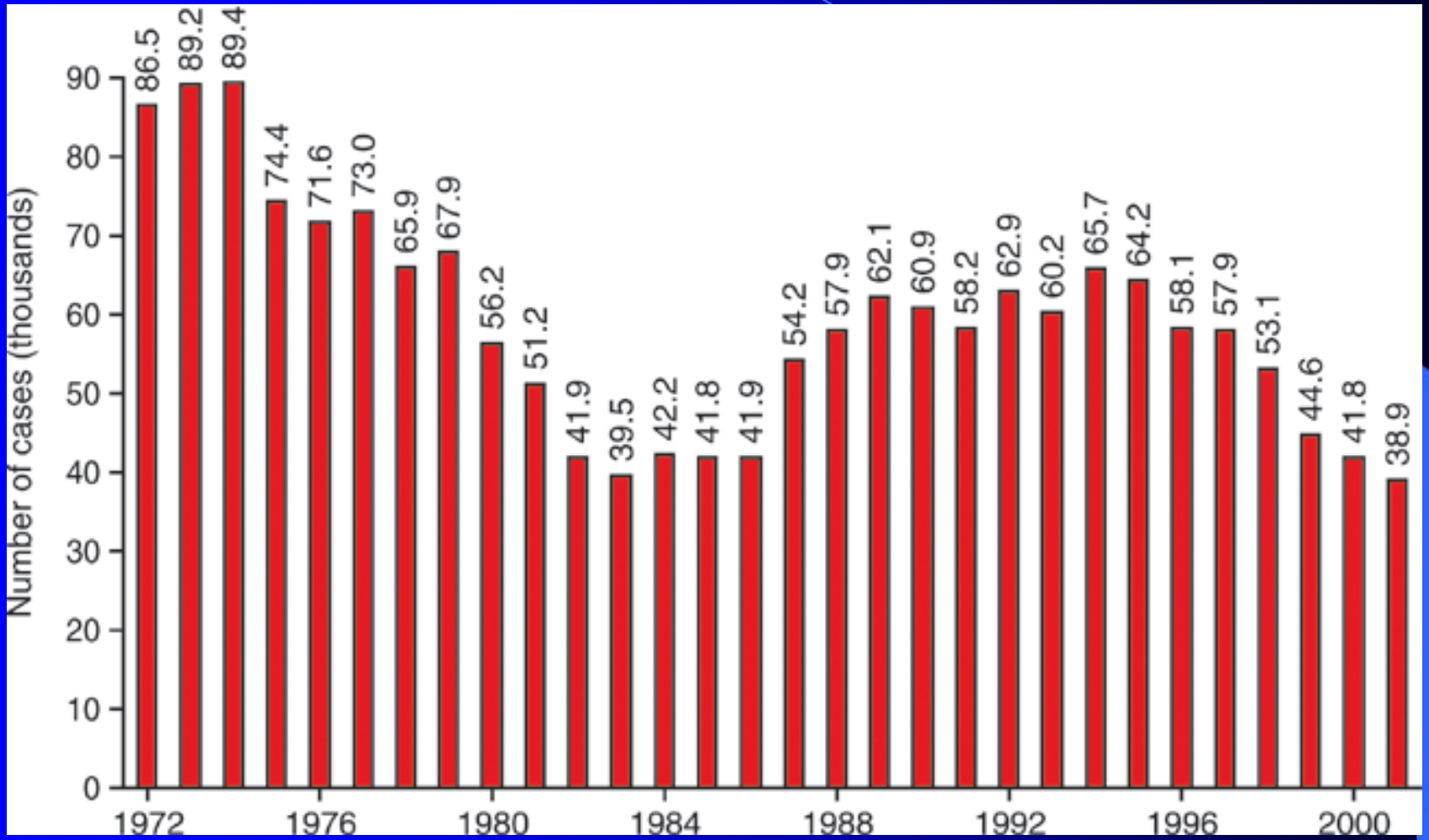
Bureau of Labor Statistics Annual Survey Limitations

- Excludes self-employed, small farms, government workers, household workers
- Self-reporting by both employee and employer (underreporting?)
- More extensive information gathered for only those cases with days away from work

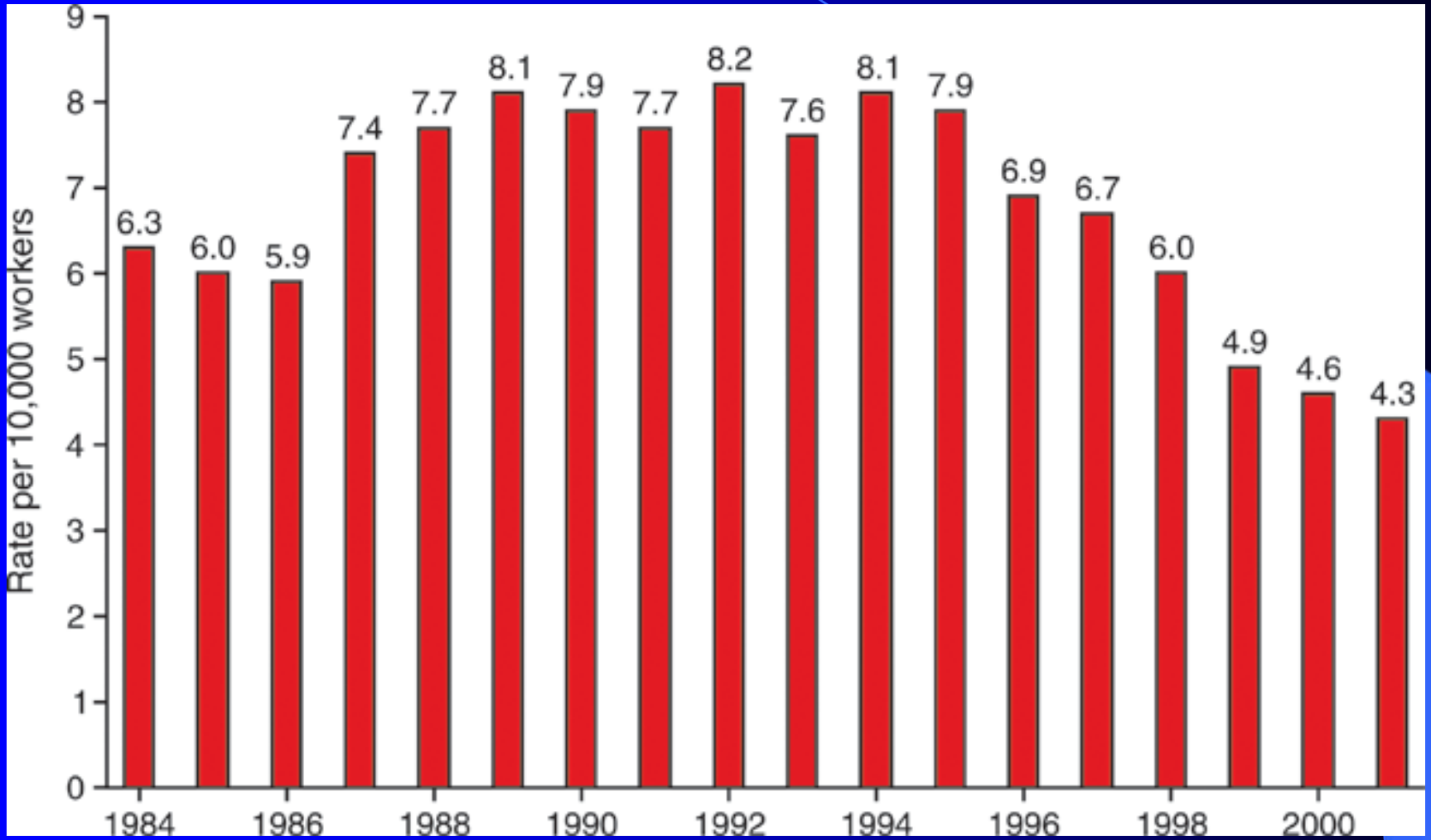
Bureau of Labor Statistics Annual Survey Limitations

- Vague definition of “occupational skin diseases or disorders” (misclassification?)
  - Illnesses involving the worker’s skin that are caused by work exposure to chemicals, plants, or other substances.
  - Examples: contact dermatitis, eczema, or rash caused by primary irritants and sensitizers or poisonous plants; oil acne, friction blisters, chrome ulcers; inflammation of the skin

Number of Occupational Skin Diseases 1972-2001



Rates of Occupational Skin Diseases 1984-2001



Bureau of Labor Statistics Annual Survey 2005

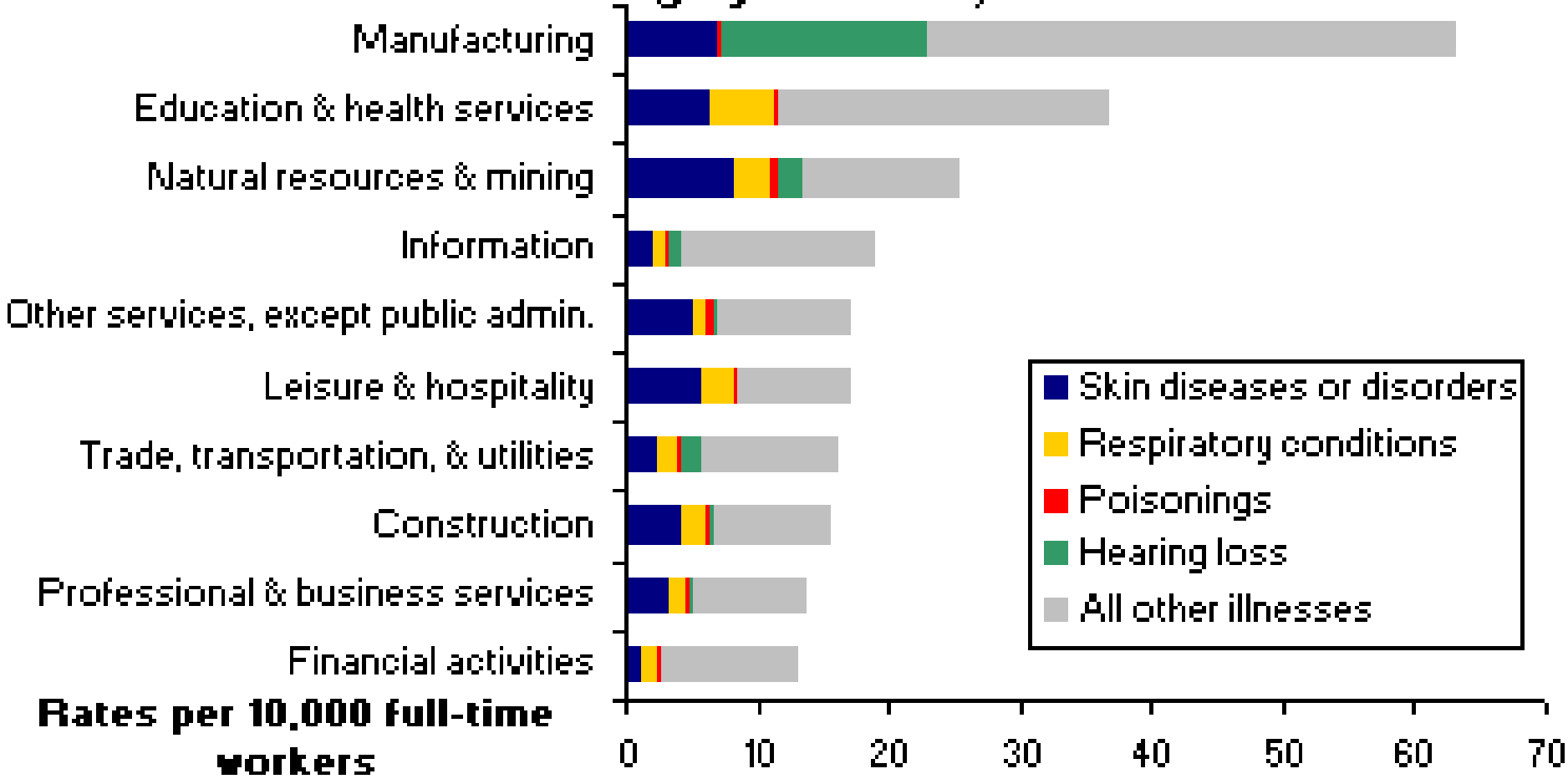
- Annual average employment 109,127,000
- Injuries 4 million
- Total occupational illnesses 242,500
- Skin diseases or disorders 40,100 (16.5%)
- Hearing loss 26,900 (11.1%)
- Respiratory conditions 20,200 (8.3%)
- Poisonings 2800 (1.2%)
- Other 152,400 (62.8%)

Numbers and Incidence
Occupational Skin Diseases BLS 2005

(N = 40,100; Incidence = 44/100,000)

	#	Per 100,000
Agric / forest / fish	**1200**	**135**
Manufacturing	**9900**	**70**
Education and health services	**8400**	**66**
Leisure and hospitality	**4900**	**58**
Other services	**1500**	**51**
Construction	**2800**	**43**
Professional and business services	**4100**	**33**
Trade/Transport/Util	**5800**	**26**
Information	**600**	**21**
Financial activities	**800**	**11**
Mining	**100**	9

Incidence rates of nonfatal occupational illnesses by industry and category of illness, 2005



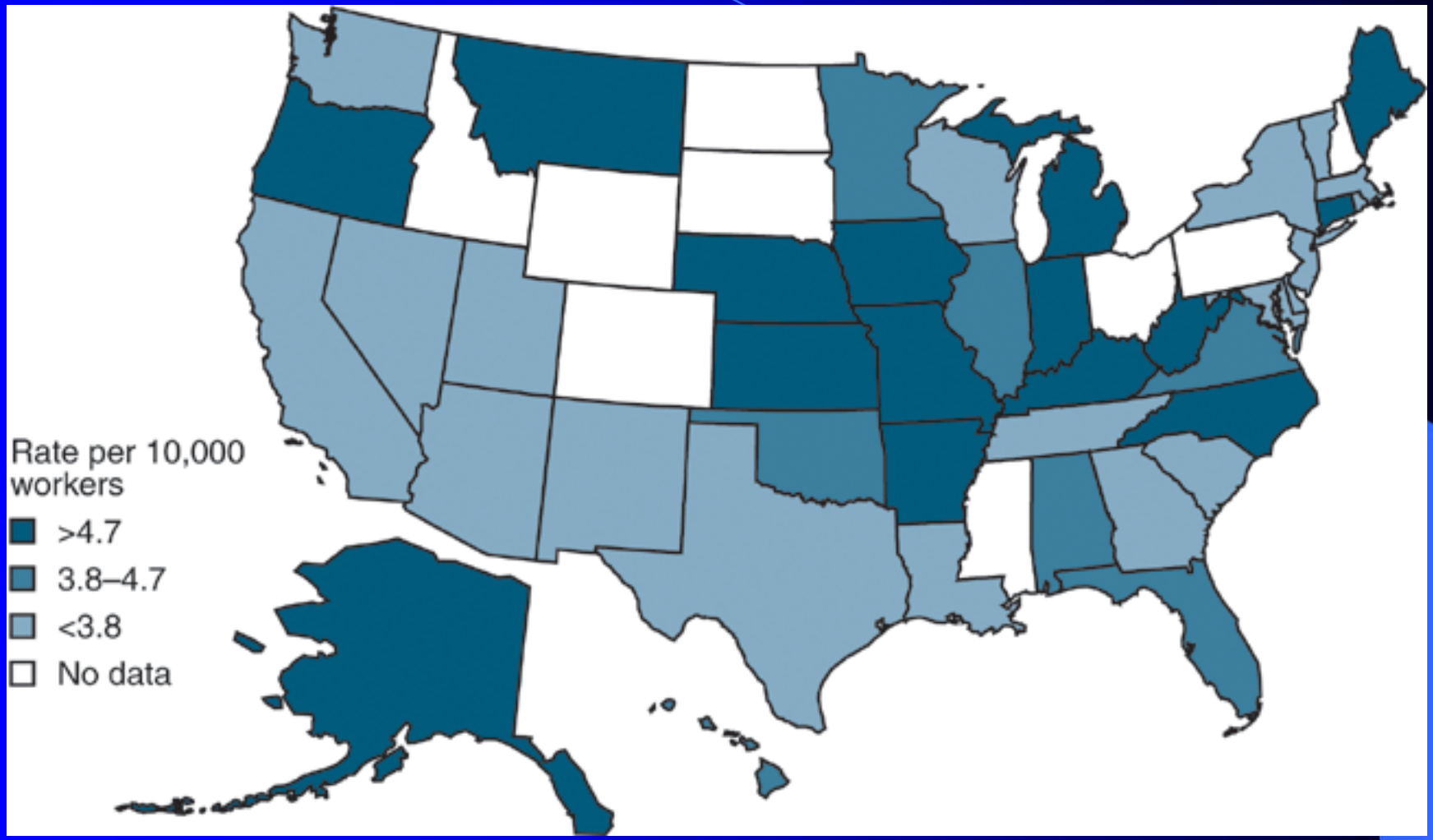
BLS Annual Survey 2005 Days Away from Work (DAFW)

- 5000 (12.5%) of the skin disease cases involved days away from work (DAFW)
- Of these cases
  - 3100 (62%) were dermatitis
  - Infections
  - Other conditions

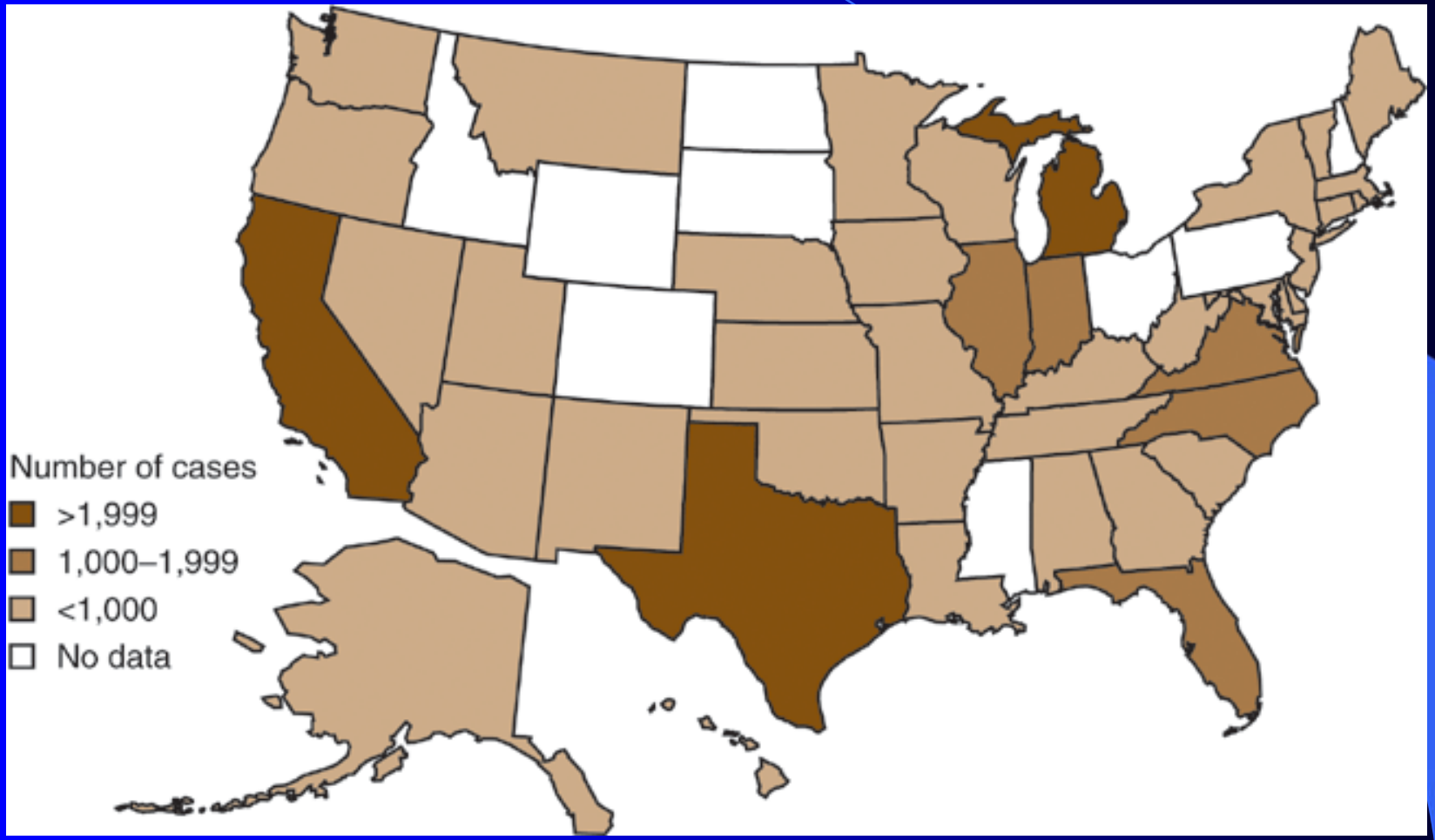
NIOSH Publication No. 2004-146
Worker Health Chartbook 2004

http://www.cdc.gov/niosh/docs/chartbook/

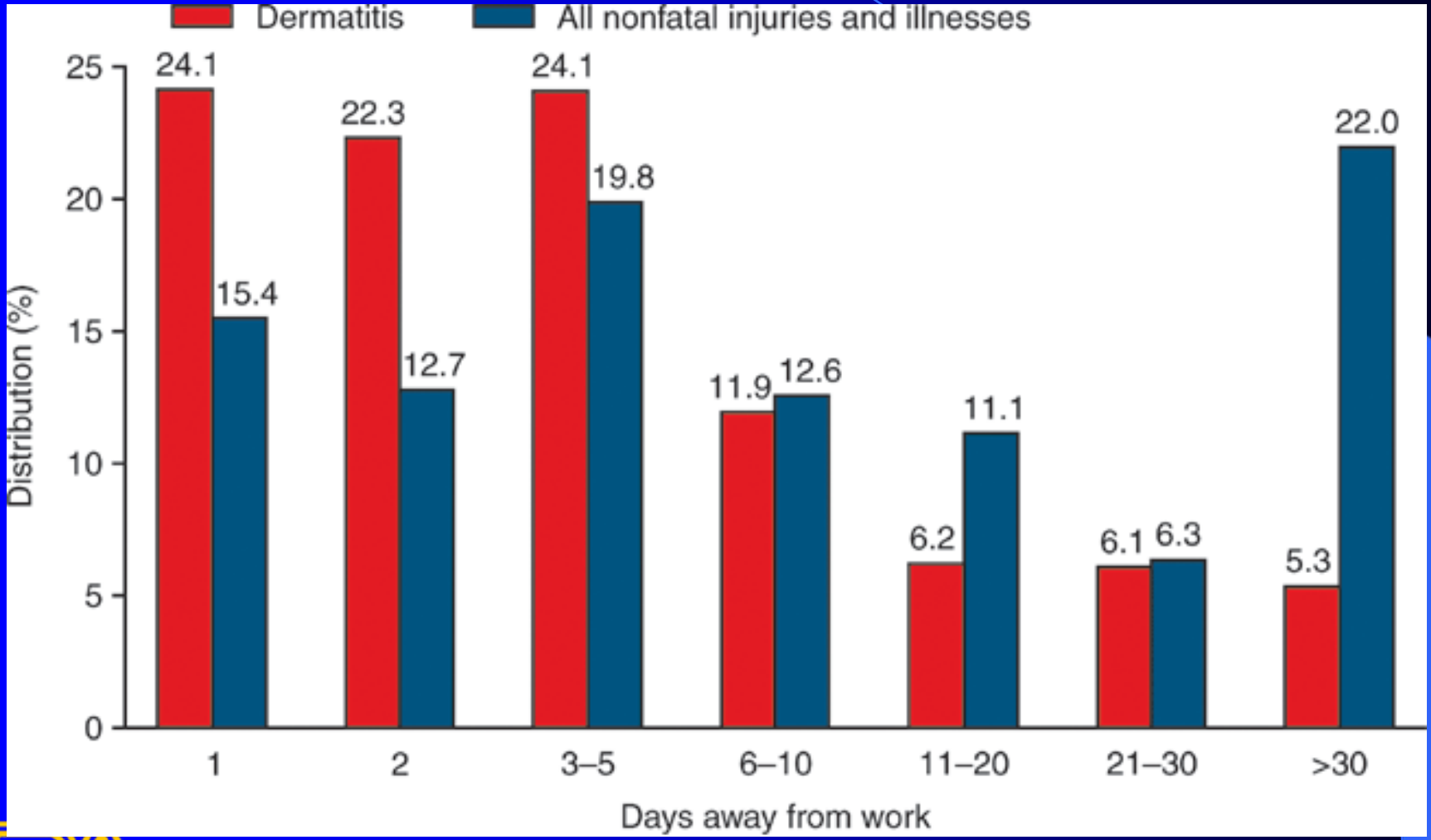
Rates of Occupational Skin Diseases by State 2001



Numbers of Occupational Skin Diseases by State 2001



Dermatitis Cases by Number of Days Away from Work (DAFW) 2001



Burden of Skin Disease Study (AADA and SID 2004)

- $37 billion for 21 skin diseases
- Includes physician visits, hospitalizations, missed work, medications (RX and OTC)
- Contact dermatitis
  - Prevalence 72.29 million
  - 9.2 million visits to offices
  - 1.6 million visits to ERs
  - Total cost $1.918 billion

Prognosis

- 235 OSD patients in telephone survey mean of 4 years after
- 40% with continuing dermatitis
  - 76% of these reported some improvement
- 37% felt work activities affected
- 29% felt household work affected
- 23% felt leisure activities affected

Holness; Am J Ind Med 27:807-815, 1995

Prognosis

- 555 patients completing follow-up questionnaire 2-3 years after
- 26% of women with complete healing
  - 22% had continual problems
  - 52% recurring
- 31% of men with complete healing
  - 29% had continual problems
  - 40% recurring

Fregert S; Cont Derm 1:96-107; 1975

Injury and Illness Surveillance Post Katrina, New Orleans

- Active surveillance from Sept 9 to Sept 25
- 7508 visits at 4 hospitals and 10 other facilities
- 4169 for illness
- 15.4% were skin or wound infections
  - 19.1% for relief workers
- 7.2% were for rash
  - 12.7% for relief workers

MMWR Vol 54, No 40, Oct 14, 2005

Injury and Illness Surveillance Post Katrina, New Orleans

- Active surveillance from Sept 25 to Oct 15
- 17,446 visits at 8 hospitals and 19 DMATs
- 8997 for illness
- 9.8% were skin or wound infections
  - 8.8% for relief workers
- 5.8% were for rash
  - 8.4% for relief workers

MMWR Vol 55, No 2, Jan 20, 2006

NIOSH Health Hazard Evaluation New Orleans Fire Department

- Skin rash reported by 258 of 525 (49%)
- Firefighters who had floodwater contact had increased risk of skin rash (PR 2.1, 95% CI 1.4-3.2)
- Depressive symptoms associated with skin rash (PR 1.7, 95% CI 1.2-2.6)

HETA 2006-0023-3003 June 2006

NIOSH Health Hazard Evaluation New Orleans Police Department

- Itching reported by 323 of 912 (36%)
- Pimples or bumps by 239 (26%)
- Redness by 232 (25%)
- Blisters by 129 (14%)
- Police who had floodwater contact had increased risk of skin rash (PR 1.5, 95% CI 1.2-1.9)

HETA 2006-0027-3001 May 2006

Public Health Impact of Disease

- How many and who are affected?
  - Common disease with high-risk occupations
- What happens to those affected?
  - Potentially chronic, lifestyle changes
- How much does it cost?
  - Economic and social impact
- Is it preventable?
  - Yes

General Causes

Occupational Skin Diseases
Physical Causes

- Friction
- Pressure
- Trauma
- Vibration
- Heat / Cold / Humidity
- Radiation (UV, visible, IR, ionizing)
- Electric current

Occupational Skin Diseases
Chemical Causes

- Water, alcohol, esters
- Acids, alkalis
- Heavy metal salts, metallo-organics
- Aldehydes
- Hydrocarbons, aromatics, polycyclics
- Solvents, resins
- Proteins, lipids
- Etc……> 57,000 irritants and >3000 allergens

Occupational Skin Diseases
Biologic Causes

- Plants
- Bacteria
- Viruses
- Fungi
- Protozoa
- Arthropods, insects

Clinical Spectrum

Occupational Skin Diseases Washington 1989-93

Body Part Affected (N=5695)

- Hands / wrists / fingers 39.5%
- Arms 17.8%
- Multiple body parts 26.8%
- Head / neck 9.1%
- Lower extremity 3.7%
- Trunk 2.4%

Kaufman, et al; AJPH, July 1998

Clinical Spectrum

- Contact dermatitis
  - irritant, allergic
- Photodermatoses
  - phototoxic, photoallergic

Contact Dermatitis

Contact Dermatitis

- Inflammatory skin condition
- Caused by skin contact with exogenous agent/agents
- Two etiologic types
  - irritant (80%), allergic (20%)
- Clinical types
  - acute, subacute, chronic

Irritant Contact Dermatitis

- Cutaneous inflammation
- Direct cytotoxic effect (nonimmunologic)
- Spectrum
  - depends on strength of irritant and level of exposure
  - acute burns to chronic eczema

Irritant Contact Dermatitis
Common Causes

- Water, soaps, detergents, cleaning agents
- Fiberglass, particulate dusts
- Food products
- Solvents
- Petroleum products, lubricants, machine oils
- Metals

Allergic Contact Dermatitis

- An immune response
  - Type IV, cell-mediated, delayed hypersensitivity
- Role of the allergen and specialized cells
  - hapten, Langerhans cells, T lymphocytes
- Two phases
  - induction, sensitization, afferent phase
  - elicitation, efferent phase

Allergic Contact Dermatitis Common Causes

- Plants (poison ivy)
- Metallic salts (nickel*)
- Rubber accelerators/antioxidants (carba mix* thiuram*)
- Plastics/resins (epoxy resins*)
- Biocides/preservatives (formaldehyde*)
- Organic dyes (paraphenylenediamine)
- Antibiotics (neomycin)
- Fragrances (cinnamic alcohol)

* Rietschel et al AJCD 13:170-176; 2002

Acute Contact Dermatitis

- Acute vesiculo-bullous dermatitis
- Irritant reaction to ethylene oxide
- Medical sterilization, fumigant

Subacute Contact Dermatitis

- Edema, erythema, scaling
- Allergic reaction to rubber accelerator mercaptobenzothiazole
- Rubber boots, rubber products

Chronic Contact Dermatitis

- Thickened, hyperpigmented, dry, fissured
- Irritant reaction to kerosene
- Solvents used to clean the skin

Photodermatoses

- Phototoxic -- furocoumarins (limes), coal tars, drugs
- Photoallergic -- fragrances, sunscreens, plants, halogenated salicylanilides

Contact Urticaria

- Natural rubber latex
- Plants and woods
- Food and animal products

Skin Cancers

- Actinic keratoses, basal cell, squamous cell, melanomas
- UV radiation, ionizing radiation, coal tar
- Outdoor workers

Folliculitis

- Pustules, comedones
- Insoluble metal working fluids

Chloracne

- Comedones, papules, straw-colored cysts, limited inflammation in malar crescent, retroauricular, axillae, scrotum

- Halogenated hydrocarbons in pesticides, wood preservatives, transformers

Dioxins

Chemical Leukoderma

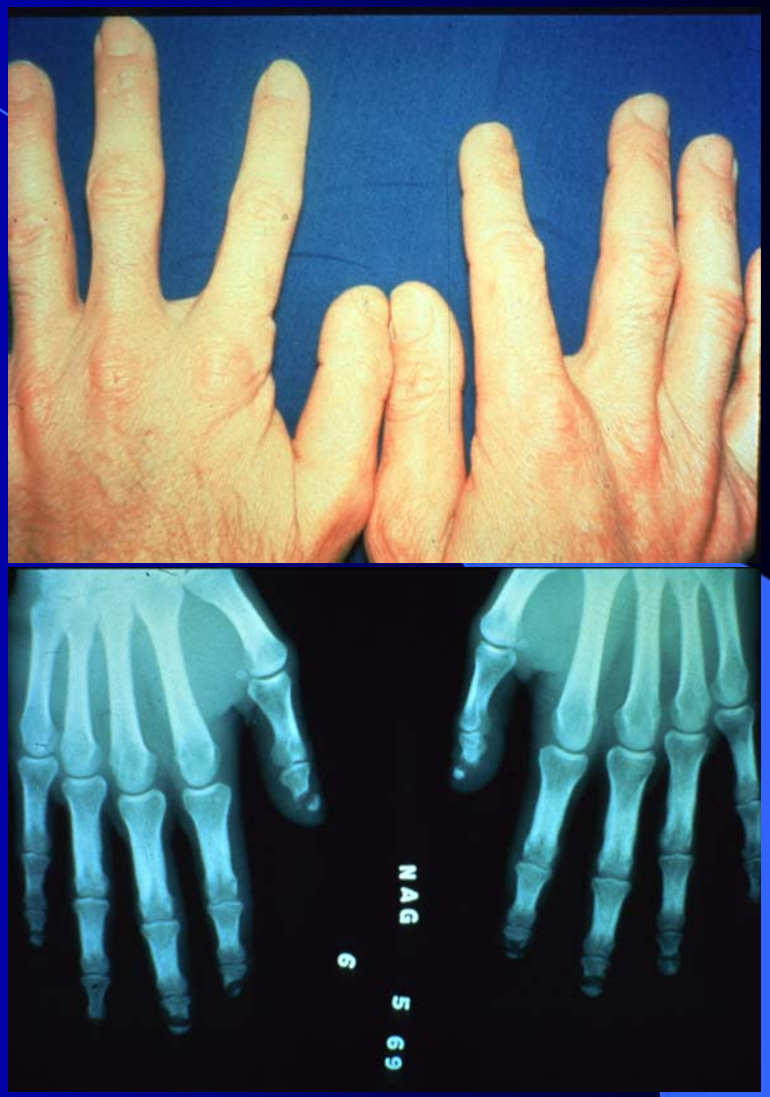
- Depigmentation
- Phenols, catechols, hydroquinones
- Germicides, insecticides, paints, plastics, synthetic rubber, oils, photographic chemicals

Vibration White Finger

- Episodic pallor, then cyanosis, then erythema, numbness
- Vibration, cold, pressure

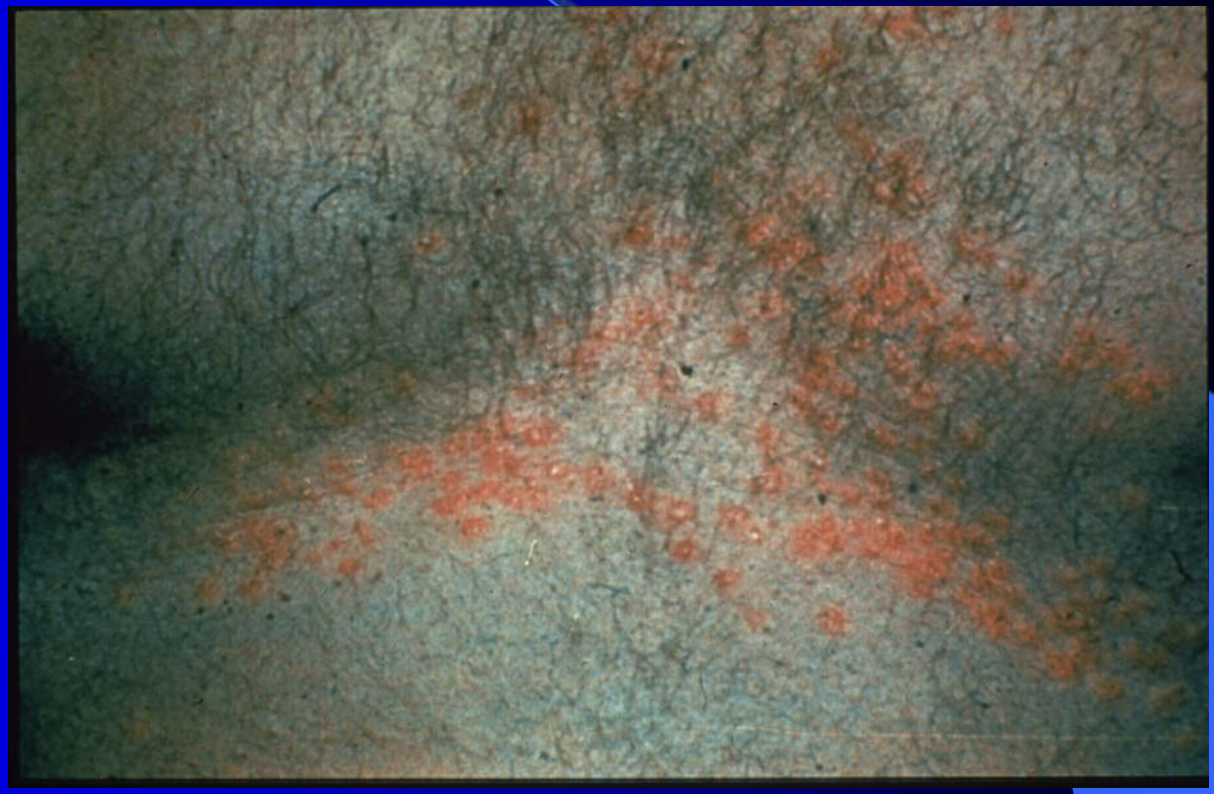
Acroosteolysis

- Shortening of terminal digits, Raynaud's, scleroderma
- Polyvinyl chloride



Miliaria

- Blockage of sweat ducts
- Hot, humid environments



Burns

- Spectrum of burns from partial to full thickness
- Alkalies, acids, electricity, thermal

Trauma

- Callosities, fibrous glass, knuckle pads

Ulcerations

- Chrome holes
- Chromic acid

Granulomas

- Focal, chronic inflammation
- Beryllium, zirconium

Nail Diseases

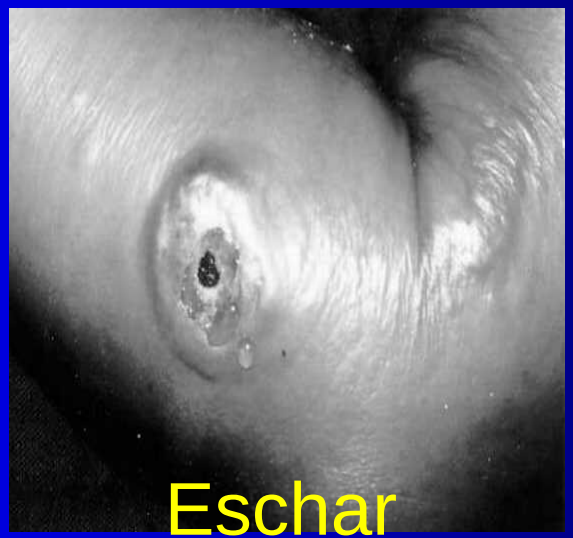
- Trauma, infections
- Wet work (Candida, Pseudomonas)

Infections and Infestations

- Anthrax
- Monkeypox
- Orf, milker's nodules, erysipeloid
- Herpes, warts
- Tinea, candidiasis
- Creeping eruption, mite dermatitis
- Tularemia
- Sporotrichosis, atypical mycobacteria, TB
- Insect-borne diseases

Anthrax: Cutaneous

Vesicle development Day 2



Eschar formation

FDA

Monkeypox

- 1958 – found in lab monkeys
- 1970 - human disease
- June 2003 – first US cases
- Reservoir - animals
- Transmission – aerosol / direct contact
- Less infectious and lethal than smallpox

FDA

www.mcw.edu/derm

Insect-Borne Diseases

- Various insects, various reactions
- Lyme disease, Rocky Mt. spotted fever, Q fever

Diagnosis

Occupational Skin Diseases
Diagnostic Assessment

- History
  - etiologic factors, accessory factors
- Physical exam
  - nature, character, distribution
- Diagnostic tools
  - cultures, biopsies, use tests
  - skin patch tests (allergic contact dermatitis)
  - skin prick tests, RAST (contact urticaria)
- Is the condition occupational?

Irritant and Allergic Contact Dermatitis -- Features

Feature	Irritant	Allergic
Itch	3+ (late)	4+ (early)
Pain/burning	4+ (early)	2+
Vesicles	1+	4+
Pustules	3+	1+
Thick/fissures	4+	2+
Reaction delay	Mins/hrs	Days

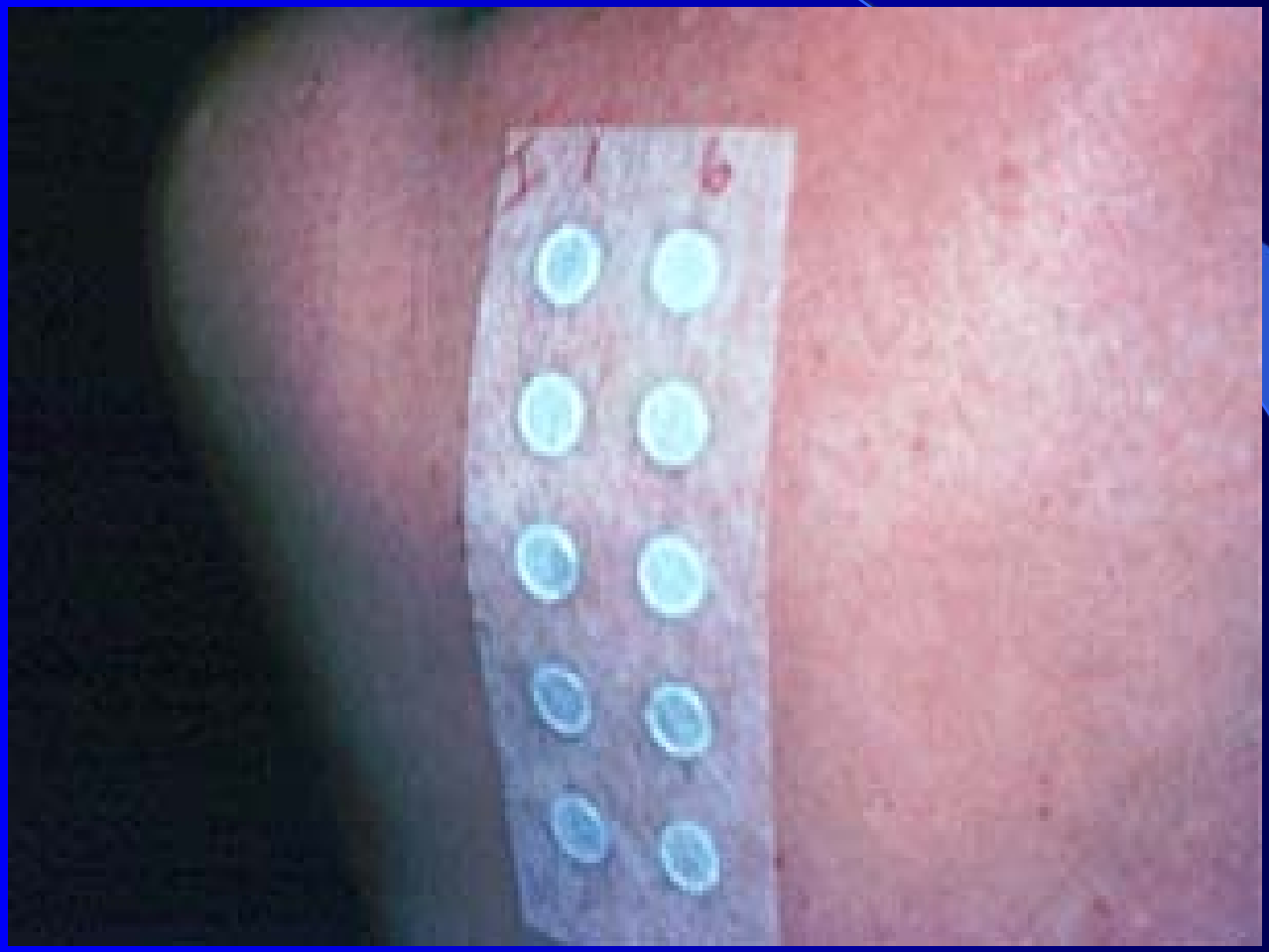
Marks & DeLeo 1982

Skin Patch Testing

- Sub-irritant concentration of chemical applied to the skin surface
- Positive response if allergic to chemical
- Issues of relevance, sensitivity, specificity, cross-reactions, false positives & negatives
- Never patch test to unknown substances!

Skin Patch Testing

Allergen Application



Contact Dermatitis Occupational Criteria

- Is the clinical appearance consistent?
- Are there workplace exposures to irritant/allergens?
  - History, MSDSs, NIOSH/EPA/other tox info
- Is the anatomic distribution consistent with exposures in the job task?
- Is the temporal relationship consistent?

Mathias JAAD 23 [1989]

Contact Dermatitis Occupational Criteria

- Are nonoccupational exposures excluded as possible causes?
- Does the condition improve away from the exposure?
- Do patch tests or use tests identify a probable causal agent?

Mathias JAAD 23 [1989]

Occupational Skin Diseases Dermatitis Treatment

- Remove the irritant/allergen
- Wet dressings
- Steroids (topical, systemic)
- Antibiotics (topical, systemic)
- Antihistamines
- Emollients
- Phototherapy

Prevention

OCET
Office of Counterterrorism
& Emerging Threats

Occupational Skin Diseases
Prevention and Control Measures

- Engineering hazard control
  - substitution, process modification, isolation
- Workplace hygiene
- Personal protection
  - clothing, gloves, barrier/protective creams
- Personal hygiene / skin care
- Education

Occupational Derm Resources

- Derm Slide show : www.cdc.gov/niosh/ocderm.html
- NIOSH Derm Exposure Research Program: www.cdc.gov/niosh/topics/skin
- OSHA: http://www.osha.gov/SLTC/dermalexposure/index.html

Occupational Skin Diseases

- NIOSH and OSHA role
- Epidemiology / Public health importance
- General causes
- Clinical spectrum
- Diagnosis
- Prevention